**Homework 113: C++ and LATEX**

Due: Thursday, 13 January, noon

**C++ Introduction**

In this class, you will need to create C++ programs using a BASH terminal environment. You are required to use clang+llvm version 7.0 or higher. You can use your own computer if you have the correct software installed, or you can use the department’s server sand. There are also native Linux computers in the nerdery that have all required software.

**Create and Run a C++ Program**

Use the following instructions to create, compile, and run a C++ program.

1. Make sure you edit the preferences of your editor to ensure you use two *spaces* for indentation with **no tab characters**. If you use Emacs, you can use [this file](https://borax.truman.edu/310/113/emacs), saved as “.emacs” (without the quotes) in your home directory, for the correct Emacs setup.
2. You can check your source file for the presence of tab characters with the command:  
   $ grep -P -n '\x09' filename.cpp
3. Use the clang compiler to compile and link the source code into an executable program by issuing the command:  
   $ clang++ -pedantic-errors -Weverything -Wno-c++98-compat -std=c++11 -o hello\_world hello\_world.cpp
4. If there are no error messages, a file named hello\_world will have been created in your directory. Make sure you can see this when you issue the command  
   $ ls -l
5. If there are warning or error messages, read them carefully, especially noting the line number or numbers which are referenced, fix the errors using the editor, save your changes, and re-run the compile command.
6. When the compiler runs cleanly and creates an executable file for your program, run the program in the terminal window with the command:  
   $ ./hello\_world

**Homework Assignment Part 1**

Follow the same procedure to create the rectangle-area program copied from [this handout](https://borax.truman.edu/310/113/rectangle_area.cpp.pdf). Remember, *no tab characters* in the file!

The purposes of this part of the assignment are:

1. Make sure you know the mechanics of editing, compiling, and running a C++ program with command line arguments in a BASH environment using the clang+llvm compilation system.
2. Give you practice with the coding style conventions of this class, including indent width, brace style, Doxygen format, and horizontal and vertical whitespace usage.
3. Illustrate how to use command line arguments, in case you’re rusty with that.
4. Illustrate the code for a fairly robust pseudorandom number generator that gives different sequences even when run very rapidly in succession. We will use this several times this semester.

Submit the C++ source code file (**NOT** the executable file) to the [homework submission](https://borax.truman.edu/310/submit.php) page.

**LATEX Introduction**

In this class, you will need to create PDF documents using LATEX as the typesetting engine. Often early in the semester, and always on tests, I will give you a template to help you get started. [Here](https://borax.truman.edu/310/113/template.tex) is the template for this assignment.

**Homework Assignment Part 2**

I am going to walk you through using Overleaf to create and typeset a document using LATEX. You are welcome to use any other LATEX system you wish

1. Open the LaTeX source code in the link above (as text) in a browser window.
2. Copy and paste the code into overleaf’s editor window.
3. On the second line of the file, replace “YOUR NAME HERE” with your preferred first name and your last name.
4. Problems 1 and 3 are complete and correct; do not change them. The remaining problems are for you to fill in the answers.
5. I strongly suggest you make a few changes at a time and then refresh typeset. Thus, if you get an error, it will be easy to know where the error is.
6. When you are finished, you will need to download both the .tex source code file and the typeset .pdf file for submission. On Overleaf, you can download the PDF directly with a single button. However, when you download the source code, it downloads as a .zip file. You will need to unzip it in order to extract the .tex file for submission.

The purposes of this part of the assignment are:

1. Make sure you know the mechanics of editing, typesetting, and viewing a LATEX source file and its corresponding PDF document.
2. See how to typeset inline math using dollar signs, display (centered) math using several different display modes, especially the align\* mode, and how to display portions of code using the Verbatim environment. The reading at latex-tutorial.com includes information about these. You should also look up the equation and splitenvironments which are in the template.

An important note is that you are not allowed to use a double backslash \\ in paragraph mode, nor are you allowed to use the command \newline.

By noon on Thursday, 13 January, submit the LATEX source code file and the typeset PDF to the [homework submission](https://borax.truman.edu/310/submit.php) page.

**Additional Notes**

For help with typesetting math stuff in LATEX, I strongly suggest you consult the [guide](http://tug.ctan.org/info/short-math-guide/short-math-guide.pdf) from AMS.

If you have mac OS, you can do the C++ work on your computer after you install Xcode version 9.0 or later. Note that for this course you need to use command-line tools in the Terminal app to ensure you are using the correct command-line switches, not the Xcode IDE. You will also need a LATEX installation, such as MacTex or TeXstudio.

If you have a Windows computer, you will have to figure out how to install and run a Linux virtual machine. Alternatively, you can install clang and llvm (minimum version 7) for Windows, the Linux subsystem for Windows, and a LATEX system such as MikTex.

The best setup for this class is to install Linux on your own computer. Assuming you have Debian Stretch or Ubuntu 18.04 or later, you will need to install the clang and llvm packages on your system, as well as a text editor such as emacs, vim-gnome, or VScode. For the LATEX assignments, you will need at least the texlive-latex-recommended and texlive-extra-utils packages to have a functioning LATEX system.

To share files between sand and your network drives, plus lots of other useful information, see the [FAQ](https://sand.truman.edu/faq/) that Dr. Bindner maintains.